

REMARKS

Claims 1-13, 16-28 and 31-36 are now pending in the application. By this paper, Claims 1 and 16 have been amended. The basis for these amendments can be found throughout the specification, claims, and drawings originally filed. No new matter has been added. The preceding amendments and the following remarks are believed to be fully responsive to the outstanding Office Action and are believed to place the application in condition for allowance. The Examiner is respectfully requested to reconsider and withdraw the rejections in view of the amendments and remarks contained herein.

REJECTION UNDER 35 U.S.C. § 102

Claims 1, 2, 5, 8, 16, 17, 20, 23, and 33-36 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Kimura et al. (U.S. Pat. No. 6,386,672). This rejection is respectfully traversed.

Independent Claim 1 recites a droplet discharging apparatus including a means for discharging a discharge liquid in the form of droplets through an aperture by mechanically deforming a piezoelectric element by a normal drive signal, a drive integrated circuit disposed adjacent to and in thermal contact with the piezoelectric element, and a substrate attached to and in thermal contact with the piezoelectric element and the drive circuit. A diaphragm is disposed adjacent to and in thermal contact with the piezoelectric element and a temperature sensor is associated with the drive integrated circuit for sensing a temperature of the drive integrated circuit. The sensed temperature of the drive integrated circuit approximates the temperature of the piezoelectric element, and the sensed temperature of the drive integrated circuit

approximates the temperature of the piezoelectric element. The approximated temperature of the piezoelectric element approximates the temperature of the diaphragm, which approximates the temperature of the discharge liquid. The droplets are discharged from the aperture by a cooling drive signal based on the approximated temperature of the discharge fluid, which is different from the normal drive signal. A flushing process is implemented between cycles of normal discharge to set the temperature of the discharge liquid to a predetermined temperature.

Independent Claim 16 recites a droplet discharge method including sensing a temperature of a drive integrated circuit disposed adjacent to and in thermal contact with the piezoelectric element, approximating a temperature of the piezoelectric element based on the sensed temperature of the drive integrated circuit, and approximating a temperature of a diaphragm disposed adjacent to the piezoelectric element. A temperature of a discharge liquid disposed adjacent to the piezoelectric element is approximated based on the approximated temperature of the diaphragm and the discharge liquid as discharged in the form of droplets through an aperture by mechanically deforming the piezoelectric element. The discharge liquid is cooled by a cooling discharge based on the approximated temperature of the discharge liquid, which is different from normal discharge. A flushing process is implemented between cycles of normal discharge to set the temperature of the discharge liquid to a predetermined temperature.

In this manner, the present teachings disclose a substrate in contact with a piezoelectric element and drive integrated circuit, as well as a diaphragm disposed adjacent to the piezoelectric element and a discharge liquid. The droplet discharging

apparatus and method of the present teachings approximates a temperature of the discharge liquid due to the relationship between the drive integrated circuit, the substrate, the piezoelectric element, the diaphragm, and the discharge liquid. See the specification at Page 15, Paragraph [0068], and Figure 3. A flushing process is implemented between cycles of normal discharge to set the temperature of the discharge liquid to a predetermined temperature. See the specification at Page 18, Paragraph [0075].

Kimura discloses an ink jet recording head including a nozzle plate (3), a flow path forming substrate (7), a piezoelectric vibrator unit (8), and an elastic plate (10). See Kimura at Col. 3, Ins. 23-61. Kimura discloses controlling a drive signal supplied to a piezoelectric vibrator (9) of the piezoelectric vibrator unit (8) based on an environmental temperature or based on a temperature of a semiconductor substrate (67) of a semiconductor integrated circuit (20) that is disposed in the vicinity of the piezoelectric vibrator (9). See Kimura at Col. 8, Ins. 40-57, and Col. 9, Ins. 9-33. While Kimura discloses controlling a drive signal supplied to piezoelectric vibrators (9) of an ink jet recording head based on an environmental temperature or a temperature of a semiconductor integrated circuit (20) disposed proximate to the piezoelectric vibrator (9), Kimura is silent with respect to implementation of a flushing process between cycles of normal discharge. Furthermore, Applicants respectfully submit that Kimura is also silent with regard to performing such a flushing process between cycles of a normal discharge to set a temperature of a discharge liquid to a predetermined temperature.

In light of the foregoing, Applicants respectfully submit that independent Claims 1 and 16, as well as Claims 2, 5, 8, 17, 20, 23, and 33-36, respectively dependent

therefrom, are in condition for allowance. Accordingly, reconsideration and withdrawal of the rejections is respectfully requested.

REJECTION UNDER 35 U.S.C. § 103

Claims 3 and 18 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kimura et al. (U.S. Pat. No. 6,386,672) in view of Kubo (U.S. Pat. No. 6,257,688).

Claims 4 and 19 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kimura et al. (U.S. Pat. No. 6,386,672) in view of Tajika (U.S. Pat. No. 5,861,895).

Claims 6 and 21 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kimura et al. (U.S. Pat. No. 6,386,672) in view of Nozawa (U.S. Pat. No. 6,499,821).

Claims 7 and 22 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kimura et al. (U.S. Pat. No. 6,386,672) in view of Mikami (U.S. Pat. No. 4,633,269).

Claims 9, 11-13, 24 and 26-28 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kimura et al. (U.S. Pat. No. 6,386,672) in view of Usui et al. (U.S. Pat. No. 6,981,761).

Claims 10 and 25 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kimura et al. (U.S. Pat. No. 6,386,672) in view of Shinoura (U.S. Pat. No. 6,714,173).

Claims 31 and 32 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kimura (U.S. Pat. No. 6,386,672) in view of Ishizaki (U.S. Pat. No. 6,454,377).

These rejections are respectfully traversed.

Independent Claims 1 and 16 are believed to be in condition for allowance in light of the foregoing remarks. Because Claims 3, 4, 6, 7, 9-13, 18, 19, 21, 22, 24-28, 31, and 32 respectively depend from independent Claims 1 and 16, Claims 3, 4, 6, 7, 9-13, 18, 19, 21, 22, 24-28, 31, and 32 are similarly believed to be in condition for allowance. Accordingly, reconsideration and withdrawal of the rejections is respectfully requested.

CONCLUSION

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action and the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,

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